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on the result of the examinations made by the commission we find the following facts clearly set forth:

1. In California, as elsewhere, *Phylloxera vastatrix* hibernates in the apterous female state on the roots; 2. The winter egg, if it exists at all, is as in the Eastern States, extremely rare on the wood above ground. Mention is made of finding occasionally dead bodies of females covering well developed eggs, and it is quite probable that these are the impregnated eggs produced by hypogean stem-mothers. It appears that the insect in California is most injurious in moist soils. In this respect, and this only, the experience on the Pacific coast seems to differ from ours on the Atlantic, for with us where normally there is an abundance of moisture the Phylloxera thrives best during dry summers. The opposite result in California is doubtless due to the fact that the conditions are there reversed.

HEARING IN INSECTS.—The sense of hearing in insects has been recently studied by Herr Gruber. He found the cockroach (*Blatta germanica*) very sensitive. On sounding a violin note when a cockroach was running across the floor, the creature always suddenly stopped. Again, a number of these cockroaches were enclosed in a glass vessel, and on making a strong sound there was evident agitation and excitement; some would fall down from the glass as if paralyzed. A cockroach was hung by a thread from its hind leg; when it was quiet a bow was drawn sharply over the violin strings at the distance of about four feet, whereupon the insect was greatly excited, and struggled round, getting its head uppermost. Beetles also were readily affected by sounds, but grubs and ants gave no certain indications. Of aquatic insects various kinds of Corixa were tried. These would often remain quite quiet for several minutes, but on tapping the glass with a glass tube they rushed about in much agitation. A disk at the end of a long rod drawn to and fro in the water near a quiet Corixa produced no effect, but on conducting the sound of a struck bell into the liquid by the rod, there was lively reaction; similarly when a glass bell stroked with a bow, was brought to touch the water. These creatures were also sensitive to high violin notes in air, to the sound of a metal plate struck with a hammer, &c. Still more sensitive to sound were various aquatic beetles (Laccophilus, Laccobius, *Nepa cinerea*, &c.). On the other hand various larvæ, especially of Ephemerides, were unaffected; but these were sensitive to mechanical agitation of the water. Herr Gruber considers the response the insects made to sound an indication of true hearing, and not mere reflex action.—*English Mechanic.*

ZOÖLOGY.

PROPAGATION OF SPONGE BY CUTTINGS.—The Journal of the Society of Arts contains an abstract of an account given by Dr. E. V. Marenzeller of the efforts made by the Austrian government to improve sponge culture in the Adriatic, from which the following is condensed:—Professor O. Schmidt expressed a conviction that if a perfectly fresh sponge were cut into suitable pieces, and these were again placed in the sea, they would grow, and in time become perfect sponges. This was put to the test by an experiment conducted in the Bay Socolizza, commenced in 1863, and concluded in 1872. Though success was rendered impossible by the determined opposition of the local populace, it did not prevent the accumulation of a mass of valuable information. The most suitable season for commencing the propagation is the winter. The growth of the sponge, and the healing of the cut surfaces, proceed much more slowly in winter than in summer; but a high temperature is dangerous, by reason of the great tendency of the sponge to undergo rapid putrefaction. As to locality, choice should be made of bays sheltered from strong waves and currents; but not quite still; the bottom should be rocky, and clothed with living algæ; and there should be a moderate ebb and flow of the tide. In all cases, the neighborhood of the mouths of rivers and subterranean springs must be avoided.

The freshness and liveliness of color of the marine algæ are sure indications of a suitable spot. The worst enemy of sponge culture is mud. The sponges chosen for cutting must be gathered by experienced hands, with all possible gentleness. They are removed either by tongs or by drag-nets.

At a low temperature in the cold season of the year, it is possible, with sponges freshly caught on the spot, to proceed at once to make cuttings from them, whilst during warm weather, it is necessary to wait and see whether any signs of putrefaction make their appearance. This reveals itself by the dullness and softness of the affected part. The dissection is rapidly performed, either with an ordinary knife, or better, with a fine saw-like blade, which is much less liable to injury by the foreign matters so abundantly found in sponge. The sponge is laid on a smooth wooden board, moistened with sea water. The size of the cuttings is usually about 26c. mil. (1 cubic inch). It is well that each cutting should have the greatest possible area of uninjured outer skin. The cuttings are placed directly in the spots where they are intended to resume growth. A healthy piece of sponge firmly attaches itself to any surface with which it comes into intimate contact in a short time. Cut sponges grow together again. The attachment takes place most rapidly when the pieces have but one cut surface, and this is laid upon the support-wood, stone, &c.

During perfect calm, for at least twenty-four hours, it is possible, according to Buccich, to plant the cuttings upon the stony sea-bottom itself, and they will hold. He saw pieces that were merely cast into the sea on an ordinarily suitable rocky bottom, during perfect calm, attached themselves and grow. Thus enlightened as to the natural habits of the sponge, Buccich prepared stone slabs, 53^{mm} thick, as a foundation. These he perforated with holes, and fastened the cuttings to them by wooden pegs driven into the holes; but it became evident that the mud and sand of the sea-bottom, perhaps also excess of light, were inimical to further growth. Lattice frames having the form of floating tables above, and with the sponges attached beneath, were tried. Professor O. Schmidt also suggested merely tying the cuttings to strong suitable strings. By the first plan there was too much shade; by the second, too much light. Buccich first constructed an apparatus composed of two planks crossing each other at right angles, with a third as a cover. This was so far successful that the cuttings were exposed on all sides to the sea, and assumed the desirable round form. He then made a modification, consisting of two boards 63^{cm} by 40^{cm}; one forms the bottom and the other the lid, and they are held parallel one over the other at a distance of 42^{cm} by two short stays, some 11^{cm} apart. In the space between these stays stones can be placed as ballast. On the top of the cover is a handle. In both planks holes are bored at 12^{cm} apart. Buccich fastened the cuttings not simply on the apparatus, but on sticks which were driven into the holes of both boards.

As material for the sticks, the common Spanish cane was used, whose siliceous rind is proof against the attacks of the pile-worm. The sticks were 42^{cm} long, and bored through at a distance of 12^{cm}, the lower end being split. On each stick three sponge cuttings were fastened in such a manner that they should lie over the bore-holes; through these, wooden sticks were thrust, and each cutting was thus fixed.

When the sponge cuttings are to be pegged only with wooden nails, a triangular stilletto will suffice for piercing. When adopting the method of fixing by sticks, such an instrument is not suitable, because much too great force would be required to make an opening to admit the sticks. Forcing and squeezing causes a loss of sarcode, the minimizing of which is the first rule that governs all manipulations of sponge. Buccich bored the cuttings with an auger with toothed edges, 6^{mm} broad, fixed to a vertical wheel driven rapidly by a little pulley. While one hand quietly presses the sponge against the borer, the other turns the wheel. In a few seconds the operation is concluded; the bore-hole is clean, the fibres are not torn, and the sarcode does not run out. When a stick is filled with cuttings, its split end is thrust into one of the holes in the support, and a wedge is driven through the slit.

As each bottom and top takes 24 sticks, carrying three cuttings apiece, one such apparatus will accommodate 144 cuttings. During the whole manipulation, until the arranging of the sponges is quite complete, they must be repeatedly and gently moistened with sea-water, especially in summer. The apparatus may be most conveniently let down and pulled up by means of a small anchor. The depth may be 5 to 7 metres.

If the cuttings hold fast after three or four weeks, the propagation is secure. A characteristic feature of the cuttings is their tendency to assume a round form. To facilitate this on every side is the chief aim of Buccich's system of supporting on sticks. As to the rate of growth of the cuttings within a certain period no rule can be given, on account of the varying conditions.

Buccich remarked that the cuttings in the first year were two or three times as large as they were originally; he further remarked that the cuttings grew better in the first and fourth years than in the second and third, a point evidently regarded as doubtful by Dr. Marenzeller; and it would seem that though some specimens may have attained a considerable size in the fifth year of transplantation, still a term of seven years is necessary to produce a marketable and profitable article.

Dr. Marenzeller also mentions the fact that besides being beautifully formed and rounded, the cuttings retain these qualities, and perfect health, with increasing size.

In conclusion, Buccich proposes the question whether the undertaking can be made profitable, and answers it in the affirmative.

Dr. Marenzeller concludes that the propagation of sponge by cuttings is not to be recommended to people without capital, but is more suited to the attention of a capitalist, or an association of capitalists, and to be conducted on a large scale.—*Journal Royal Microscopical Society.*

THE CIRCUMPOLAR DISTRIBUTION OF CERTAIN FRESH-WATER MUSSELS, AND THE IDENTITY OF CERTAIN SPECIES.—In a recent paper[1] suggested by the occurrence of the remains of fresh-water mussels (Anodons) associated with other fossils in the sedimentary strata of the Carson City prison yard, read by Dr. Stearns before the California Academy of Sciences, the author in an elaborate review of the subject, expresses the opinion that the European *Anodonta cygnea* + *Anatina*, should be added to the circumboreal list with other fresh-water mollusks, including *Margaritana margaritifera*, among the lamellibranchs, and *Limnæa stagnalis*, *L. palustris*, and *L. auricularia* (as represented by *L. ampla); Physa hypnorum* and *P. fontinalis* (by *Physa heterostropha)*, among the gasteropods.

With the exception of *A. cygnea*, the above species have long been regarded by the most conservative authors as circumboreal in their geographical range.

The author also considers the Eastern American species, *Anodonta imbecilis* Say and *A. fluviatilis* Lea, from New England waters, inclusive also of *A. implicata*, from the same region as identical with *A. anatina* or some of the numerous varieties of

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[1] "On the History and Distribution of the Fresh-water Mussels and the Identity of certain alleged species." By Robert E. C. Stearns. Proc. California Acad. Sciences, November 20th, 1882.

A. cygnea, of which Dr. Lea has listed no less than *one hundred and six synonyms.* As *A. anatina* is shown to be but a varietal or conditional aspect of *A. cygnea*, therefore these alleged American species are regarded as belonging to *A. cygnea.*

Dr. Stearns also includes in this identity with *A. cygnea*, the West American forms known heretofore as *A. nuttalliana*, *A. wahlamatensis*, *A. oregonensis*, and *A. californiensis;* these are traceable to Cygnea, through its Anatina aspect or condition, as well as through others of the many varieties of Cygnea, which have led to the extensive synonymy above referred to.

Specimens of *A. anatina*, from Regent's park, London, laid upon valves of *A. californiensis*, so-called, from Owen's river, California, he found to agree exactly in incremental lines and in final or peripheral outline.

He further shows how specimens of *A. cygnea*, at a certain stage of growth, would, if collected at the time when the shell had reached said stage, have been called Anatina, but not having been collected until said stage of growth had passed, became by subsequent growth Cygnea. The absurdity of regarding species thus made as valid, is self-evident.

The fresh-water mussels of the Colorado desert are associated with contemporaneous molluscan forms like Physa, Planorbis, Tryonia and Amnicola in the Carson City prison-yard, the same form (of mussel) is found with evidences of higher but extinct animal organizations like that of Elephas, a species of horse, a deer, a wolf, a wading bird, possibly the footprints of a human being, but more likely the tracks of a great sloth like Mylodon. The molluscan remains are identified by Dr. Stearns as belonging to Sphærium and Physa. The fresh-water mussels are the same as are now found living a few miles away in Washoe lake, and specimens from this lake are exactly like those from Bear river and Utah lake in Utah Territory, and further the specimens from these various points are closely like the Anatina aspect of *A. cygnea.*

The paper presents also reviews past and present geological and physico-geographical conditions, and assigns the Carson footprint beds to the uppermost tertiary.

The general tenor of the paper, which is quite lengthy, sustains Professor Weatherby's view as to the earliest fresh-water mollusca being lacustrine.

ON THE EASTERN RANGE OF UNIO PRESSUS (LEA).—This species was originally described by Dr. Lea, and figured (in Trans. Am. Phil. Soc., Vol. III, 1830, pp. 450–451, plate XII.) under the name of *Symphynota compressa*, from Ohio, and also from Norman's Kill, near Albany, where it was found by Dr. Eights. It has since been found in the northern canal at Troy, N. Y., by T. H. Aldrich; at the outlet of Owasco lake, by Dr. Jas. Lewis; and in a small lake in Herkimer Co., N. Y., which empties over a rocky bed, with numerous falls into Mohawk river (May, 1877), by R. E. Call (vide AM. NAT. for July, 1878, p. 473). DeKay in his Mollusca of New York (p. 191), mentions receiving it from Sandy creek in Jefferson county, and from Oak-orchard creek in Orleans county. Professor C. B. Adams in his Fresh water and land Shells of Vermont (vide Thompson's History of Vermont, 1842, p. 166), says: "The species * * * has its eastern limit in the streams west of the Green mountains." He also describes under the name *plebius* Adams, a variety found in a small brook near Middlebury in that State. Mr. F. R. Latchford of Ottawa, Canada, informs me that the species has been found quite recently in the Rideau river by Mr. Tyrrell, of the Canadian Geological Survey; this is I think the most northerly point from which it has been obtained. I have just received it from Winooski river, at Winooski, Vermont, where it was found by Mr. Geo. H. Hudson. As Winooski is situated near the outlet of Winooski river, where it falls into Lake Champlain; and as Middlebury, the source whence Professor Adams obtained his specimens is located upon Otter creek, a stream flowing northerly into the same lake, it is not improbable that embryonic shells have been carried down to the lake by freshets, and that the species will be found inhabiting the lake in close proximity to the outlets of these rivers; with its northern connection, specimens may find their way to the St. Lawrence water system, and thus extend the range north and east. It seems probable that the species has been introduced to the Herkimer county lake in which Mr. Call found it, by the agency of water fowls, from some of the sources here mentioned, two of which lie within a radius of less than one hundred miles of the point in question.—*A. F. Gray, Davenport, Mass.*

BITHINIA TENTACULATA (LINN.).—This European fresh-water shell, first recorded from Oswego, N. Y., by Rev. W. M. Beauchamp (June, 1879), vide AM. NAT. for July, 1880 (p. 523), has been found recently (Sept., 1882), upon the wharves at Burlington, Vermont, by Geo. H. Hudson. It will thus be seen that the species has found its way into Lake Champlain, and may soon be looked for, if circumstances are favorable to its distribution, in the St. Lawrence water system, with which this lake communicates. In the Mohawk river, near Mohawk, N. Y., where the species was planted by the late Dr. Jas. Lewis, the species has become very abundant, it being more frequent in the bends of the river, where the water moves slowly.—*A. F. Gray.*

NEW LOCALITIES FOR LIMAX MAXIMUS (LINN.).—This European slug was found at Cambridge, Mass. (May, 1882), by Professor Alpheus Hyatt. It has more recently been found at Cincinnati, Ohio, where it was discovered in a cistern on Third street; the latter specimens were collected in the autumn of 1882, and are now in possession of the Cincinnati Society of Natural History. The species was first discovered in this country by Mr. Samuel Powel in a garden at Newport, R. I., in 1868; it has also been found at Philadelphia and Brooklyn.—*A. F. Gray.*

A BLIND COPEPOD OF THE FAMILY HARPACTICIDÆ.—The interest now centering upon these animals, which through peculiarities in their habitat have dispensed with important organs, may warrant the mention of a case of the disappearance of the eyes in an order of Crustacea in which it has not been hitherto noticed so far as I know.

While collecting marine Copepoda in the Gulf of Mexico a gathering was taken from a very slightly saline marsh, a ditch passing through the marsh affording the only water of sufficient depth in which to use the net. This ditch is about eighteen inches in breadth, but of moderate depth, and extends continuously for some distance; it is so shaded by high salt sedge grass as not to be found save by accident. The gathering here secured proved to contain a new species of the sub-family Longipediinæ and closely allied to the genus Bradya established by Boeck in 1872 for a marine Copepod dredged in rather deep waters about North Europe.

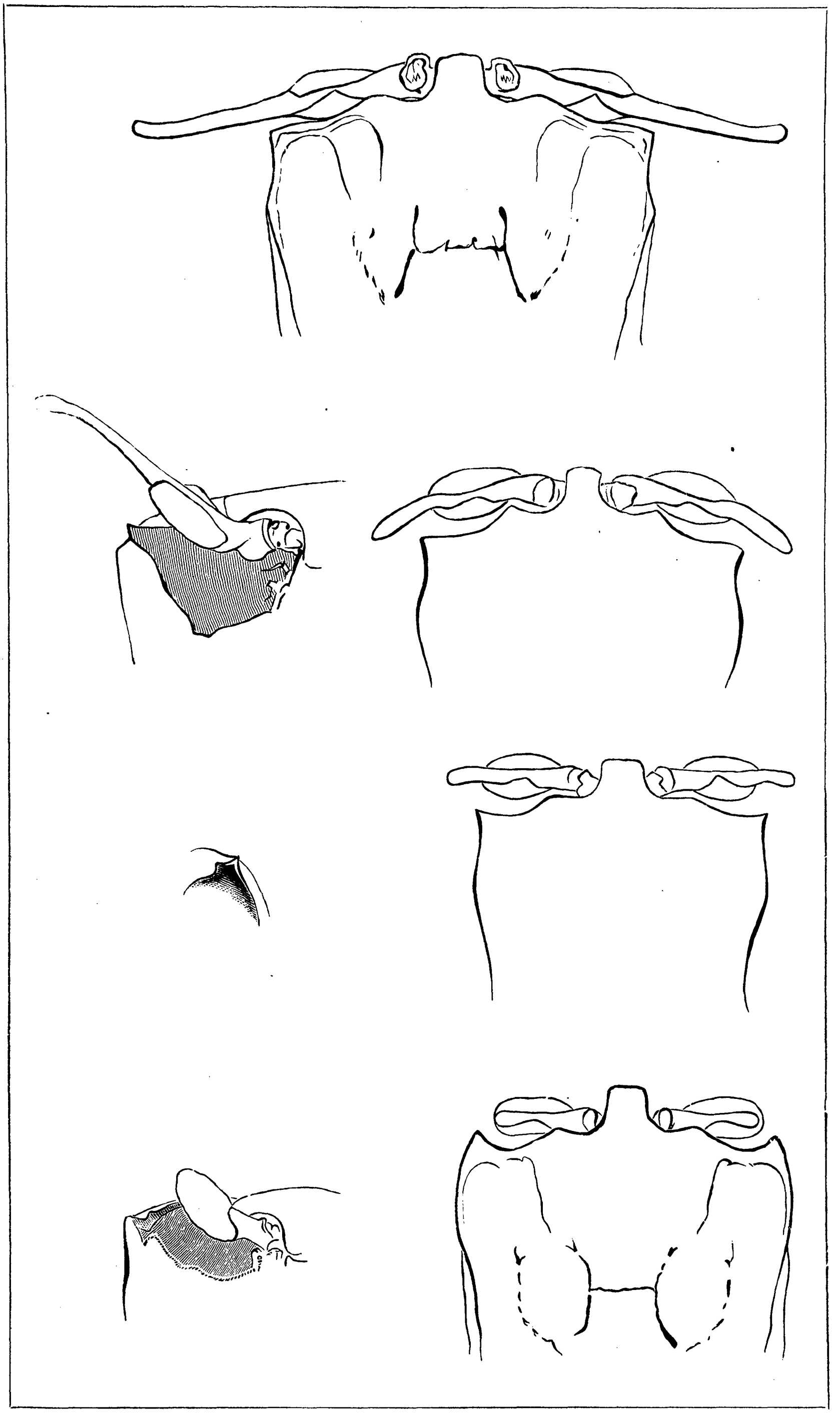
The American species, which has been named *Bradya limicola* in allusion to its muddy habitat, was found to lack in both sexes the pigmented eyes which in other Harpacticidæ are so conspicuous in the center of the forehead or on either side. It is to be regretted that lack of opportunity to repeatedly collect this interesting species, and to endeavor to ascertain if truly pelagic species also inhabit our waters, robs this discovery of much of its interest.—*C. L. Herrick.*

THE SUCKER ON THE FIN OF THE HETEROPODS IS NOT A SEXUAL CHARACTERISTIC.—The posterior margin of the "fin" of the three genera of Heteropoda, Pterotrachæa, Firoloides and Carinaria bears a small sucker-like body which many authors say is characteristic of the male of Pterotrachæa and Firoloides.

This structure is sometimes found on the fin of the female. Among a number of specimens of *Pterotrachæa coronata* Forskal, collected at Villa Franca, South France, I find a perfect female Pterotrachæa with this organ as well developed as in the males. I have also studied specimens of *Firoloides lesueurii* Eyd. Soul, in which ovaries were well developed where the sucker was present. Most observers agree in saying that Carinaria has the pinnal sucker in both sexes.

This organ is probably not confined to either sex in the above mentioned genera. Morphologically it may be regarded as a functionless organ or the remnant of a structure which in those Gasteropoda from which the Heteropods sprung was of great importance. The free-swimming habits which these active mollusks

PLATE IV.



Forms of Ocypoda or Sand-Crabs.

have, caused its reduction to a rudimentary organ.—*J. Walter Fewkes, Cambridge, Mass.*

ON THE ORIGIN OF THE SPECIES OF OCYPODA, OR SAND-CRABS, FROM THE BONIN ISLANDS.—The species on which the following observations are made was obtained from the Bonin islands in the year 1880. It seems to be closely allied to *Ocypoda arenaria* Latr., described and figured by M. Edwards, in the Hist. Crust., Vol. II, Pl. XIX, Figs. 13 and 14,

Among numbers of specimens obtained, we can at once distinguish two widely different forms; the one with the eye-stalk enormously produced beyond the edge of the carapace, and the other with the normal eye-stalk. The former has the anterior border of the carapace wavy; the wave beginning with its highest point on the exterior angle of the orbit descends gradually outwards till it ends, with its lowest point, on the external angle, which is about 90°. The lateral edge forms a concave face externally for a short distance. The anterior gastric groove has its concave face internally

In the short-eyed form on the contrary, the same anterior border of the carapace is deeply concave anteriorly, the two forming an acute angle, which consequently points anteriorly. The anterior gastric groove has its convex face externally. Again a deep notch on the border of the orbit below, and near to the external angle of the carapace, is found to be entirely wanting in the former. Lastly the last abdominal somite but one is narrower in the former, and in the male, widened near the middle, but little posteriorly. The measurement of the whole abdominal somite shows similar proportions.

I will here annex the measurement of the somite from a female crab, in which the eye measures 11^{mm}, and the stalk beyond measures 8^{mm} side by side with the normal or the short-eyed form.

	Long-eyed.	*Short-eyed.*
The greatest width of the somite, last but one..........	20.3^{mm}	21.0^{mm}
The least width of the same..........................	8.5 “	9.5 “
The greatest length do	11.0 “	10.0 “
The least length do	9.0 “	8.1 “

The following is the measurement taken from the entire somite:

	Long-eyed.	*Short-eyed.*
Length..	35.5^{mm}	34.0^{mm}
Breadth...	24.0 “	25.0 “

Similar differences of measurement occur also in the male, which I need not cite here.

Such great differences are, I think, enough to distinguish these two forms as two distinct species, had there not been a series of forms standing as stepping stones between them.

By the comparison of a number of specimens we detect a form in which the eye-stalk is but slightly produced, appearing as a slight notch. Closer examination of this form will reveal to us that the anterior border of the carapace is less convex than in the short-eyed one, thus approaching somewhat to the long-eyed form. Sometimes, in others, we find a slight notch in the orbit in place of the deep one found in the short-eyed form, departing thus somewhat from the long-eyed form and approaching more to the short-eyed.

Of these various features, the eyes form the most important, for in them we have the complete series of intermediate forms beginning with the long-eyed to the short, The extraordinary length of the eye-stalk beyond the eye proper, is to be accounted for either as representing an embryonic form or as the further differentiation of the normal eye. Viewed in the former light, it may be supposed to have originated as an appendage upon whose basipodite the ocular differentiation has taken place. In this respect it accords with Professor Huxley's view, in so far that the eye is considered as an appendage, while it differs from the views of Claus and F. Müller, who deny the appendicular character of it. Whatever the views may be, we are quite certain that here in these forms we see the specific differentiation going on before our eyes. We do not know from the specimens before us whether all these various forms come from a single parent, or whether each had a parent like itself.—*C. Ishikawa, University of Tokio, Japan.*

HETEROGENESIS IN THE COPEPOD CRUSTACEA.—In a former paper we have considered examples of heterogenesis furnished by the Cladocera. Let us now turn our attention to the copepods, the *Cyclopoiclea*, with the view to discover if similar conditions exist here also.

The standard books upon the non-parasitic forms of the Copepoda by Claus[1] and Brady[2] enumerate many species, but do not agree entirely in synonymy, nor does it seem probable that, Claus, who alone has done most of the anatomical and embryological work in this section, has followed the life-history of anything like a large proportion of the species named.

It has been long known that the marine forms of Copepoda have a very extended geographical range, many of them seeming to complete the circuit of the earth's longitude and to extend over several zones of its latitude[3]. Similar and often identical forms occur in the Mediterranean and North seas, over all Europe and the British Isles. Certain genera, as Calanus and Chetochilus, seem to extend through all degrees of latitude from the equator to the most northern seas.

A confirmation of these facts may be sought in the works of

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[1] C. Claus: Die Frei Lebenden Copepoden. Leipsig, 1863.

[2] G. S. Brady: Copepoda of British islands, Roy. Soc. 1878–9.

[3] Claus; Op. cit., pp. 83–86.

Claus, Dana, Leydig, Jurine, Baird, Fischer, Müller, Lubbock, Boeck, Brady, Heller, Lilljeborg, Sars, Uljanin, etc. As yet, however, it is too soon to say how far this similarity may extend.

Confining ourselves, for the present, to fresh-water forms, a recent opportunity for comparison of American with European Copepoda has confirmed our impression that a large number of species will be found identical[1]. It seems, indeed, somewhat astonishing at first to discover that the isolated pools of the Central United States contain species identical in every particular with those of England, Scandinavia or Germany, but such is certainly the case. In fact the populous genus Cyclops has few new species in America relative to the number identical with transatlantic forms.

A Diaptomus, believed to be identical with *D. castor* in typical as well as several varietal forms, occurs throughout Minnesota from the shores of Lake Superior to near its southern boundary and in Illinois. Another species believed to be nearly allied to a Scandinavian species is known from Minnesota, Wisconsin and the neighborhood of East St. Louis, Illinois. *Cylops serrulatus* Cls., with similar variations to those noticed by Claus (Op. cit., p. 85) and Brady (Op. cit., vol. 1, plate 22) occurs as our most abundant species.

It may be observed that Brady's work is so strictly systematic that his figures are frequently little more than schematic, and lack the life-like character of those in the earlier work of Claus. It would seem that some of the species of Cyclops described by Dana[2] are identical with the above, although details are wanting to identify positively. Without delaying to discuss the question opened as to whether these widely separated forms have all diverged from a primitive geographical center or have arisen independently from original marine prototypes, as suggested to the writer by Professor Leuckart, we may remark that the former theory is rendered possible by the fact that the feathers of water-fowl often form a vehicle for the transportation of even larger crustacea.

Amphipods, for example, are transported hundreds of miles under the feathers of geese. While it is unlikely that these larger crustaceans or their eggs would survive a long aerial journey, it is quite certain that the eggs of Cyclops would pass many hours or even days without being destroyed. On the other hand, it seems that some entomostraca are in a nascent condition which permits a slight change in the environment to induce remarkable alterations in structure which are uniform wherever this change is effected[3] and if this be not now the case with all, it may have been so at one time with the prototypes of our fresh-water copepods.

To return to the question of heterogenesis. Selecting the larger species of Cyclops, say *C. signatus* (= *C. coronatus* Cls.), we find a form not at all rare but less abundant than *C. tenuicornis* with which it seems to be constantly associated. In our investigations we found Signatus almost constantly larger, *in the same gathering*, than Tenuicornis. The only distinction, among those given by either Claus or Brady, which is constant is the following: in Signatus the last joint of the antennæ has a longitudinal ridge shaped like a pruning knife-blade extending beyond the end in a hook with the proximal two-thirds of its length strongly toothed. (The only other species which has teeth on the first joint is a species allied to *C. parcus* Her. found in Alabama, but this has no knife-like ridge.) The two species agree in having the ridge which extends nearly to the base of the antenna; they both have certain series of spines arranged upon definite parts of the antennæ; both have the circular series of spines on the basal joint of the fifth foot; in short there is a complete agreement even to the microscopic details—aside from the teeth above mentioned.

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[1] Herrick: Copepoda of Minnesota. Rep. Geol. Surv. Minn. 1881.

[2] J. D. Dana; Wilke's Exploring Exp. Crustacea.

[3] Siebold and Kölliker, Zeitschrift. 1872, p. 293. Packard; synopsis of Phyllopod crust. N. A. U. S. Geol. and Geog. Surv. of Col. 1873. p. 614, etc.

Nevertheless it is possible to pick out Signatus from a glass of the other form by its larger size and different color as well as to detect a different relation in proportional length of the caudal setæ, etc. Close examination fails to discover an earlier stage of Signatus while Tenuicornis is constantly accompanied by males and smaller forms as well as the larval stages. The curious fact is demonstrable that these species of the section of Cyclops with 17-jointed antennæ become sexually mature long before they are perfect in form. In this species it is no uncommon thing to see females of less than half the size of the adult with ova sacs. Indeed it is common to meet larvæ in which the antennæ are as yet composed of but few joints in a similar condition. This fact alters our conception of a species considerably, inasmuch as it has been thought sufficient to prove the maturity of a specimen to find the egg sacs developed. A glance at the literature of this family will suggest that in more than one case a species has been founded upon a larva which was simply prematurely gravid.

In *Cvlops serullatus* the same fact is more easily observed, as the species is so easily recognized as to be unmistakably at an early stage. The var. Montanus Brady, is not at all a variety due to station as suggested by him but, if our observations are correct, is the last form, in exceptional cases of the common species. It is but a step further to show that as *C. tenuicornis* is a more advanced stage of the small Cyclops forms with larval characters, so *C. signatus* is but a post-imago of the former. In truth not only in this species but in all others which we have had opportunity to examine, there appear at favorable opportunities unusually large and somewhat altered forms. These large, or post-imago stages appear to be dependent upon abundance of food and a shallow, warm habitat.

The species considered identical with *Diaptomus castor* is abundant and varies in size and particularly in color. So marked are these differences that it would be difficult to believe at first sight that they are not indications of specific distinction but these changes are dependent upon food, light and other similar circumstances. The typical form is found oftenest in rather large pools with no outlet, but which do not actually dry up in summer. In length the female is often $\frac{15}{100}$ cm. sometimes less and not seldom more. In the smaller females the eggs are observed to be usually fewer, but of the same size $\frac{11}{1000}$ cm. to $\frac{1}{100}$ cm. Recently, however in a small and very shallow marsh which is frequently entirely dry, but which lies near a less shallow pool swarming with the common Diaptomus (both being half a mile distant from any other water) we found a new species of dimensions considerably exceeding those given by Brady for var. Westwoodii[1]. Closer examination showed that the size and color were the only marked differences, antennæ and first pair of feet being identical, while the fifth pair of feet were but little different and these differences were seemingly but the intensifying of the characters of the smaller species to form the larger. Here there were two pools, which within our personal recollection formed but a single body of water and were now separated but by a dozen steps, only differing as to depth and muddiness, in the one of which flourished *all stages* of the ordinary form, while in the latter the *one* enlarged form alone existed. The conclusion is almost forced upon us that the second pool needed only similar conditions to bring forth this final stage of twice the usual size (but with eggs but little larger—$\frac{11}{1000}$ cm.). Shortly afterward the more shallow pond dried up entirely so that no more of the larger form could be obtained.

It is not necessary to emphasize the fact that just such insignificant variations furnish the data upon which the generalizations of modern science must stand or fall. A most interesting field is open to any one with the opportunity to rear such forms as these under conditions which can be altered at will in order to discover what farther structural changes can be artificially induced.

The practical value of the fresh-water copepods can hardly be overstated since they are scavengers and almost entirely feeders upon animal matter. The aggregate amount of putrid flesh which the Cyclops fauna of a quart of water will consume is quite remarkable, as any one may satisfy himself by watching the decay of such a creature as a polliwog in a jar of stagnant water.—*C. L. Herrick.*

THE SEGMENTATION OF THE VERTEBRATE HEAD.—In a paper entitled "The segmental value of the cranial nerves," published in the Journal of Anatomy and Physiology, by A. Milnes Marshall, the author gives a clear statement as to the theory of the segmentation of the vertebrate skull, which was proposed by Gegenbaur, and is now generally accepted. While Oken, Gœthe, Owen and

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[1] Op. cit. p. 60.

others taught that the skull consisted of a certain number of modified vertebræ; and Müller and others investigated the cranial nerves in the light of this theory. Gegenbaur has more recently shown that the method of these anatomists was wrong, and that the segmental nerves and visceral arches are the factors. In Mr. Marshall's own words: "While the school of morphologists we first dealt with, determined the number of the segmental nerves by that of the skull-segments, Stannius showed conclusively that there was no relation whatever between the two, but that there was a very definite and remarkable one between the segmental nerves and the visceral arches." Gegenbaur went a step further, and, starting with the segmental nerves and visceral arches, determined from them the number of head-segments, thus completely reversing the order of proceedings of the older school.

Within the last five or six years the comparative anatomy and embryology of the cranial nerves have engaged the attention of observers; the foremost among them being the late Professor Balfour and Mr. Marshall. After giving a clear summary of the evidence of the segmental value of the cranial nerves, Marshall then considers these nerves in order. The paper closes with a convenient tabular view, while the illustrations aid the learner very materially in understanding this difficult subject.

ANOMALY IN THE FLEXOR LONGUS OF THE FOOT.—In the dissection of a human subject, I have found a peculiar and anomalous relation of the long flexor of the foot, showing apparently an interesting case of reversion to an ancestral form. The subject was that of an adult male, and the anomaly consisted of a strong tendinous connection, about an inch in length, between the tendons of the flexor longus digitorum and flexor longus pollicis, in the region where they cross each other on the instep. This union is a permanent feature in the foot of the gorilla, where the flexor of the great toe sends on a branch, which, after uniting with the long flexor tendons of the second and fifth toes, divides into the perforatory tendons of the third and fourth toes. In the ordinary man the big toe can be flexed to a considerable extent independently, but the subject in which this peculiar arrangement was found, as in the gorilla, could not have flexed the great toe at all without an equal flexure of all the toes—*S. W. Williston, New Haven Conn., Nov. 22, 1882.*

ROTIFERS WITHOUT ROTARY ORGANS.—The most striking characteristic of this class of animals is the possession of rotary disks; yet it appears that species of Rotifera exist that have all other characters of the class, but are devoid of vibratile cilia. The first to notice this was Dujardin, who, in 1841, gave the name of *Lindia torulosa* to his discovery. Gosse, in 1851, described a form with similar characters. Doubt was thrown upon these observations, but Dr. Joseph Leidy has recently (Proc. Phil. Acad., 1882,

243) added to the list of non-ciliated rotifers, and brought together the scattered information upon the subject. In the Proc. Phil. Acad., 1857, page 204, Dr. Leidy described a rotifer-like creature quite different from those before mentioned, and having a large protractile pouch or cap in lieu of the usual rotary disks. This he named *Dictyophora vorax*. Still another species was described by Mecznichow in 1866; and, another, parasitic upon worms, was observed by Claparéde in 1867. In 1882, Mr. S. A. Forbes described a form which Dr. Leidy suspects to be identical with *Dictyophora vorax*. The last discovery of Dr. Leidy is a rotifer in which a sort of head, in the form of a cup prolonged at the mouth into an incurved beak, takes the place of the rotary disk of ordinary rotifers. This creature, which is named *Aryclus inquietus* was found occupying a central position among a group of the rotifer, *Megalotrocha alba*, both parasitic upon a Plumatella from Fairmount dam, upon the Schuylkill.

THE VERTEBRATES OF THE ADIRONDACK REGION.—Dr. C. Hart Merriam has published in the Transactions of the Linnæan Society of New York, the first part (Mammals) of an interesting work on the Vertebrates of the Adirondack region. The observations are fresh and authentic, the results of about twenty years exploration in winter, as well as summer, in those wilds. Few mammals, says Dr. Merriam, are commonly seen by those who traverse the forests of the Adirondacks. "This is in part due to the nature of their haunts, partly because they do not roam about much in broad daylight, but chiefly because of their shy dispositions and wary habits. The experienced hunter, more familiar with their haunts and ways, falls in with a larger number; still, by far the greater portions go unobserved. Of the forty-two kinds found here, I have myself seen living, and in the wild state, all but three; therefore the remarks upon their habits, in the following biographies are, when the contrary is not stated, drawn largely from the results of personal observation."

After discussing the geological history, topography, climate, general features, botany and faunal position of this interesting region, Dr. Merriam begins his account of the forty-two mammals of the Adirondacks, beginning with the Carnivora. In the introduction he describes a "mixed flock" observed during the fall migrations. "At this season one may hunt for hours and scarcely see a bird, when suddenly he finds himself surrounded by a host of individuals, representing many species and pertaining to widely different families." In one such flock there were at least fifty robins, all very noisy, several blue jays, large numbers of slate-colored snow birds, a few white-throated, song and fox-colored sparrows, a couple of winter wrens, and one Nashville warbler; beside these near at hand, were a dozen chickadees, with an equal number of yellow birds, and a few golden-crowned kinglets, with several red-bellied nuthatches and a pair of brown creepers. "I have seen the purple finch in some of these mixed flocks, and a few hairy and downy woodpeckers, and hermit thrushes sometimes hang about their outskirts, but the latter are more commonly seen by themselves in groups of half a dozen or thereabouts."

The account of the panther contains considerable new matter. Dr. Merriam insists that it never climbs trees unless very young, or when pursued by dogs.

It is stated that a panther can leap an almost incredible distance. "On level ground a single spring of twenty feet is by no means uncommon, and on one occasion Mr. Sheppard measured a leap, over snow, of nearly forty feet." Important notes in its breeding habits are added. Some fallacies regarding the alleged fierceness of the panther, its mode of capturing its prey, its size and its mode of carrying its prey, are exposed, and the statement made that the panther cries and screams is called in question, those who have had to do with panthers being the most skeptical in regard to their cries. The Canada lynx, wild cat, wolf, fox, wolverine and the fur animals, and the raccoon and bear are described with many new facts or corrections of popular errors; and finally the harbor seal, which has in three instances appeared in Lake Champlain. As regards the change to a white pelage in winter of the weasel and ermine, Dr. Merriam combats the common notion that it is due to temperature, and suggests that it is due to falls of snow, the change sometimes taking place within forty-eight hours after the ground becomes covered with snow. The series, when completed, will be a fresh and valuable contribution to our knowledge of the wild animals and birds of the Eastern United States.

A Curious Nudibranch Mollusk.—A very singular animal, which lives in green ulvæ, on the shores of the Mediterranean, and which was regarded as a flat-worm by Schultze, has been lately shown by L. Graff in the Morphologisches Yahrbuch, to be really not a Turbellarian worm, but "the very lowest of all known Nudibranchs," and identical with what Kölliker long ago described as *Rhodope veranii*. It is very small, being only 4^{mm} long, with a breadth $\frac{1}{3}^{\text{mm}}$, and while closely like ordinary flat-worms, it is distinguished from them by its anus, by the structure of its generative organs, its central ganglia, and its sensory apparatus. Graff does not regard this worm-like mollusk as descended from the present specialized Dendrocœla, but from a group of Rhabdocœlida. Professor Graff does not suggest that this may be a degraded Nudibranch, which has lost its gills, buccal mass and radula, but may this not be the case? In that event it can hardly be a stem-form. This could be readily tested by a study of its embryology. The ordinary Nudibranchs seem rather to have descended from shelled mollusks, as the embryos are provided with a temporary shell and vellum. At the same time we grant that mollusks and Turbellarian worms may have arisen from the same stem-form.

ZOOLOGICAL NOTES.—Dr. C. F. Holder is authority for the statement he makes in the *Scientific American* that a basking shark (*Cetorhinus maximus*) about seventy feet long was caught off Block island. Sir Charles Lyell records one nearly fifty-five feet long that came ashore at Rathesholm Head, at Stronsa, parts of which are now in the British museum. ——Mr. W. A. Stearns on his return from his trip to Labrador, wrote us that the polar bear had not, so far as he could ascertain, been seen this year below Rigoulet. "Year before last (1880) a walrus was killed at Fox harbor, St. Lewis sound. One of our young men secured the tusks, and has them now in his possession. The people there say that they see them frequently, but rarely get them. One was caught three years ago (1879) also at the same place."——An apparently new species of dog, supposed to have been received from the Upper Amazons, has been described in the Proceedings of the Zoölogical Society of London under the name *Canis microtis.*——Professor Flower also exhibited and remarked on the skull of a young chimpanzee from Lado, in the Soudan, which exhibited the deformity called acrocephaly, associated with the premature closure of the fronto-parietal suture.——Mr. Dobson maintains that the Dipodidæ belong with the hystricine, and not to the murine rodents.——The genus Psolus has been divided into three subgenera by Professor Bell.——M. Jourdain, of Marseilles, has recently published in the *Comptes Rendus* of the French Academy, an abstract of his studies on the finer structure of the male sexual organs and the Cuvierian organs of Holothurians, also on the histology of the digestive canal, nervous system and polar vesicles of these Echinoderms; his researches, made at the marine zoölogical laboratory of Marseilles, will be completed by studies in the circulatory apparatus of these animals.——A crinoid was obtained during the voyage of H. M. S. *Alert*, which was referred by Professor Bell to a new variety of *Antedon eschrichtii* of the arctic seas.

PHYSIOLOGY.[1]

THE RECENT ACCESSIONS TO OUR KNOWLEDGE OF THE PHYSIOLOGY OF THE HEART.—The heart in its final function is simply a pump, and it would no doubt be possible to remove this organ from the body of a living animal, and replace it by an artificial machine which should, for a time, serve very well the purposes of the heart in the circulation of the blood. As the circulation of the blood is every instant necessary to vital activity, and as, other things remaining the same, any change in the force or frequency

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[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.